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# FAUNA ASSOCIATED WITH IN-GROUND SUBTERRANEAN TERMITE MONITORING AND BAIT STATIONS IN SOUTHERN CALIFORNIA

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*Abstract.*—The invertebrate associates of outdoor, in-ground subterranean termite monitoring and bait stations are reported from two locations in southern California. The potential negative impact on baiting by Argentine ants, earthworms, and millipedes are discussed. Problems with Argentine ant abatement within subterranean termite baiting arenas are examined.

*Key Words.*—Insecta, Isoptera, subterranean termite, non-target invertebrates, In-ground monitoring and bait stations, Argentine ants.

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Applications of liquid termiticides to soil have been the standard method of subterranean termite control in the United States for over 40 years. Initially chlorinated hydrocarbon termiticides were used. In the late 1980s these were replaced with organophosphate and pyrethroid insecticides. A number of factors including lack of soil persistence for at least one organophosphate (Gold et al. 1994), customer dissatisfaction and fears about pesticide use in and around residences and workplaces, and increased ineffectiveness of soil applied termiticides have created a market for baits to control subterranean termites (unpublished data).

The concept of using baits to control subterranean termites has been researched for many decades (Su 1993). Randall & Doody (1934) demonstrated that termite colonies could be suppressed by injecting slow-acting arsenic dusts into their galleries which were spread throughout the colony by social grooming. Research in the 1970s showed that Mirex treated wooden blocks suppressed field populations of *Reticulitermes* spp. (Beard 1974, Esenther & Beal 1974, 1978). Natural populations of subterranean termites were also suppressed when a Mirex paste bait was injected into infested galleries (Gao et al. 1985). The availability of novel chemistries with unique modes of action in the 1980s and 1990s permitted current investigators to take the concept of baiting for subterranean termite control to the next level (Haverty & Howard 1979; Jones 1984, 1989; Su & Scheffrahn 1993; Su 1994; Su et al. 1995; Pawson & Gold 1996; Su & Scheffrahn 1996).

The first subterranean termite bait to obtain registration for use in California was an in-ground delivery system, the Sentricon Colony Elimination System (Dow AgroSciences, Indianapolis, Indiana). For pictorial presentations and other details pertaining to this system, refer to Fehrenbach (1994) and Dow AgroSciences (1996). This control strategy entailed placing a station in the soil which initially held wooden monitoring devices. When termites discovered and began feeding on the monitoring devices they were captured and transferred into a Baitube® (Dow AgroSciences, Indianapolis, Indiana) which contained Recruit II® (Dow AgroSciences, Indianapolis, Indiana) termite bait (0.5% hexaflumuron, a chitin synthesis inhibitor). The Baitube® containing the captured termites was then placed in the in-ground station. It was assumed that the toxicant would be dis-

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tributed throughout the colony by trophallaxis eventually bringing about its demise (Esenther & Gray 1968, Haverty & Howard 1979, Su 1994).

During inspections a variety of animals are frequently found within in-ground subterranean termite monitoring and bait stations. However, no field data are available on the composition of the invertebrate fauna of in-ground termite stations and their possible negative effects on termite baiting. The manufacturer's reference manual (Dow AgroSciences 1996) refers to slugs and insects such as ants and cockroaches present in stations as creating "conditions NOT conducive to termites." It also described actions to take to remediate invasions by these animals into stations.

This paper presents data on the fauna found within in-ground subterranean termite monitoring and bait stations from two locations in southern California.

## Materials and Methods

On 5 Dec 1995, 58 Sentricon® (Dow AgroSciences, Indianapolis, Indiana.) subterranean termite monitoring stations were installed on a residential property in south Ontario, San Bernardino County, California. These stations were inspected each month from Jan 1996 through Dec 1997. During the inspections, each stations was opened and visually inspected. The monitoring stakes were then extracted and quickly placed in a clean food storage tray measuring 30 × 20 × 5 cm. They were then carefully disassembled and examined using an OptiVisor optical glass binocular magnifier (Donegan Optical Company, Kansas City, Missouri). Animal species present, which could be identified in the field, were counted and recorded. Specimens needing laboratory identification were removed with forceps or a small camel hair brush, placed in vials containing 70% alcohol and subsequently identified using a microscope.

When a Baitube® was present in a station, it was carefully extracted and quickly placed in a clean food storage tray as described above for the monitoring stakes. The tube was uncapped and visually inspected. Animal specimens visible on top of the bait matrix within the tube were identified and recorded. The Baitube® was then turned upside down and the laminated textured cellulose (LTC) bait matrix (Dow AgroSciences, Indianapolis, Indiana) was gently tapped out into the food storage tray. Using chemical resistant nitrile gloves, the bait matrix was unfolded, and all animal species located within it were counted, identified, and recorded. In opening the bait matrices observations were made regarding scarification and damage to the matrices caused by animals found within them. Subterranean termite activity in bait matrices is always characterized by the presence of fecal spotting and soil. Thus it is relatively easy to distinguish subterranean termite activity in bait matrices from that caused by other non-target organisms which were present within them.

Additional field data were obtained from inspections made on 500 Sentricon® in-ground subterranean termite monitoring and bait stations which were installed on a large apartment complex on Feldner Road, the City of Orange, Orange County, California in Oct 1996. There are two large structures at this location which are separated from each other by an asphalt driveway. Each building encircles a courtyard in its center. When the monitoring stations were originally installed at this location they were numbered in a sequential manner from one to 500 and their locations were noted on a graphical illustration of the property.

Table 1. Fauna recorded from outdoor in-ground subterranean termite monitoring and bait stations on southern California.

| Genera/Species | Common names |
|---|---|
| *Helodrilus* sp. | Earthworm |
| *Helix aspersa* (Muller) | European brown snail |
| *Agriolimax* sp., *Limax* sp., *Milax* sp. | Slugs |
| *Bipalium kewensis* Moseley | Arrow-headed flatworm |
| *Beuthobius arizonicus* Chamberlin | Centipede |
| *Julus hesperus* Chamberlin | Millipede |
| *Armadillidium vulgare* Latreille | Pillbug |
| *Porcellio laevis* Koch | Sowbug |
| *Porcellio scaber* (Latreille) | Sowbug |
| *Talitroides sylvaticus* (Haswell) | House hopper (Amphipod) |
| *Latrodectus hesperus* Chamberlin & Ivie | Western black widow spider |
| *Entomobrya* sp., *Isotoma* sp. | Springtails (Collembolans) |
| *Forficula auricularia* L. | European earwig |
| *Euborellia annulipes* (Lucas) | Ring-legged earwig |
| *Conoderus* spp. | Wireworms (Elaterids) |
| *Gryllus assimilis* (F.) | Field cricket |
| *Blatta orientalis* L. | Oriental cockroach |
| *Peridroma saucia* (Hubner) | Variegated cutworm |
| *Linepithema humile* (Mayr) | Argentine ant |
| *Pogonomyrmex californicus* Buckley | California harvester ant |
| *Solenopsis xyloni* Mc Cook | Southern fire ant |
| *Paratrechina vividula* (Nylander') | An ant (no common name) |
| *Hypoponera* sp. | An ant (no common name) |

Four visits were made to the Feldner Road site during 1997. During these visits every fifth station ($n$ = 100) was inspected as outlined above for the Ontario site. In addition to these four visits, two other visits were made to this location. On 23 Oct 1997, 250 stations around one structure at the Feldner Road site were inspected and on 24 Nov 1997, the remaining 250 stations around the second structure were checked. This was done so that data could be obtained from all the stations at this location at least once during 1997.

## Results and Discussion

Table 1 shows a list of invertebrates encountered within outdoor in-ground subterranean termite monitoring and bait stations at two locations in southern California. A variety of invertebrates used these stations and their contents as a source of food, harborage, and nesting sites. The presence of most of these invertebrates within the stations does not seem to interfere with the foraging and feeding activities of subterranean termites. A few species may be detrimental because they appear to interfere with the baiting process. The deleterious effects engendered by species exhibiting the most negative impact are discussed below.

*Ants*.—Five species of ants were found within in-ground subterranean termite monitoring and bait stations at the two locations studied (Table 1). It can be anticipated that in other geographic areas, different ant species are likely to be found in these stations. Of the five ants recorded, the Argentine ant, *Linepithema humile* (Mayr), was the most pervasive, pernicious, and ubiquitous species found harboring and/or nesting within in-ground subterranean termite monitoring and bait stations. Depending on the time of year inspections were made, Argentine ant infestations in stations range from 11% to 46% of stations inspected during the course of this study. At another subterranean termite monitoring/baiting site on a residential property in Santa Ana, Orange County, California, seven of 27 stations (26%) became infested with Argentine ants within three months after installation. Based on two years of experiences at fifteen different sites in three counties in southern California, it would appear that the extent of Argentine ant infestations within in-ground subterranean termite stations are influenced by geographic location, time of year, availability of moisture, presence of vegetation supporting honeydew-secreting Homopterous insects, extent of irrigation, and thoroughness of pest control practices being carried out on a property (unpublished data).

Ants are universal predators of termites (Wilson 1971, Holldobler & Wilson 1990). They have been described as the most active and effective enemies of termites (Hegh 1922). Argentine ants are aggressive, opportunistic predators of subterranean termites and once they occupy a termite station the termites usually abandon it. In two years of field work with in-ground subterranean termite monitoring and bait stations in southern California, I have never found a station simultaneously occupied by the western subterranean termite, *Reticulitermes hesperus* Banks and Argentine ants.

The activities of Argentine ants in outdoor in-ground subterranean termite monitoring and bait stations can deter termite foraging and also cause termites already present in a station to leave. This can be a challenge to successfully using in-ground bait stations for subterranean termite control.

Seeking out and destroying Argentine ant nests with appropriate insecticides in and around a subterranean termite baiting arena will help to mitigate this problem. However, the Argentine ant is an opportunistic, nomadic, fugitive species and reinvasion of unoccupied habitats will rapidly reoccur particularly during periods of high ant activity. Argentine ant control within subterranean termite baiting arenas will have to be an on-going, vigilant process. Diligent Argentine ant control programs is structural environments within subterranean termite baiting arenas are going to be costly and laborious. Thus, ant control within a baiting arena should be executed by the same pest management company which is also performing the termite baiting program. Having a vested interest in the success of the termite baiting program may encourage a pest control company to expend the necessary effort to control Argentine ants and thus keep them out of the stations.

*Earthworms.*—A new bait matrix, reported as being laminated textured cellulose (LTC), and sometimes referred to as "white paper toweling" (Potter 1997) is currently being used in the Sentricon® colony elimination system. Although this matrix is more palatable to subterranean termites than the previous wood flour matrix, it is also palatable to earthworms. I found earthworms in 1% of the bait matrices feeding on and tunneling within them. Earthworm activity, including feeding, tunneling, and the creation of castings in the bait matrix, hastens its decomposition and degradation.

*Millipedes.*—*Oxidus gracilis* (Koch) and *Julus hesperus* Chamberlin are two species of millipedes frequently found within in-ground subterranean termite monitoring and bait stations. Millipedes generally feed on decaying organic debris including decaying wood and vegetable matter (Ebeling 1975, Hogue 1993, Bello

1997). *Julus hesperus* was found feeding on, burrowing in, and damaging LTC bait matrices in 4% of the in-ground stations at the locations studied. This millipede is also commonly found feeding on the surfaces of decaying wooden monitoring devices in subterranean termite stations.

*Spiders.*—The western black widow spider, *Latrodectus hesperus* Chamberlin & Ivie, was often found within in-ground subterranean termite monitoring stations in southern California. The presence of this spider did not appear to interfere with foraging and feeding activities of subterranean termites. However, the presence of black widow spiders in these stations is a potential safety concern especially if one reaches into a station to remove the extractor using unprotected fingers.

## CONCLUSION

A number of non-target animals were found within in-ground monitoring and bait stations used for subterranean termite control in southern California. These animals may interfere with the effectiveness of the bait by deterring and/or driving out the target termites or damaging the bait matrix. The presence of black widow spiders poses a potential health hazard to people servicing the stations.

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